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BUILDING COMMISSIONING

for better public buildings

CASE STUDY

BAINBRIDGE ISLAND HIGH SCHOOL — ASSURING HVAC COMFORT AND EFFICIENCY

Bainbridge Island High School addition

In 1998, Bainbridge Island School District in Western Washington began a major addition and modernization of their high school. Three separate construction phases encompassed 31 new classrooms, a new gymnasium, substantial renovations to classrooms for art, family and consumer sciences, and photography, as well as renovations to the core administrative area.

The construction also included major improvements to the existing core mechanical systems. The district wanted to eliminate air quality problems they'd been experiencing and optimize efficiency of the heating, ventilating, and air-conditioning (HVAC) system.

Soon after construction began, the district contacted the Washington State Department of General Administration (GA). Through GA's building commissioning program, they developed a scope of work and hired Keithly/Welsh Associates, Inc. (KWA) to commission the new and existing HVAC systems.

COMMISSIONING QUICK FACTS

Building Name	Bainbridge Island High School
Location	Bainbridge Island, Washington
Project	Addition & Remodel
Commissioning Scope	HVAC & energy management control system
Building Size	133,000 sq.ft. (addition and remodel)
Total Construction Cost	$20,622,000
Total Commissioning Cost	$41,860
Commissioning as % of Construction Cost	0.2%
Commissioning Cost per Square Foot	$0.32
First-Year Cost Benefit	$25,300
Annual Energy Savings	$19,500 per year

PROJECT PARTNERS

Washington State Department of General Administration
Roger Wigfield

Bainbridge Island School District
Richard Best and
J.R. Fulton

Keithly/Welsh Associates, Inc. (Commissioning Agent)
Pete Keithly

Burr Lawrence Rising + Bates Architects
John Wegener

Tres West Engineers
Jack Halsey

The Vemo Company
(General Contractor)
Don Owen

Stirrett Johnson
(Mechanical Contractor)
Brian Johnson

> This decision, to hire an independent commissioning authority ... has proved invaluable.
>
> Richard Best
> Bainbridge Island School District

PROJECT SCOPE OF WORK

This commissioning and retro-commissioning project was limited to the following equipment:

- A new direct digital control (DDC) system with a graphical user interface
- 2 new gas-fired boilers and associated hydronic pumps and piping
- A new water treatment system
- 31 new fan coil units
- 4 existing unitary rooftop variable-air-volume HVAC units with multiple terminal boxes and associated pneumatic controls
- 12 existing fan-coil units and associated pneumatic controls
- 2 large existing central air handlers and multiple associated duct coils and pneumatic controls

KWA worked closely with the contractors and school district staff to identify issues related to the HVAC systems. School staff also participated in functional testing of the systems. KWA noted that both the design and contractor teams were cooperative in assisting with the commissioning process, and in seeking resolution of all issues.

ISSUES IDENTIFIED

KWA identified more than 100 significant issues through site inspections during the construction and functional testing phases. Among these issues were:

- Insufficient clearance of the new steam boiler as originally installed. If this had not been discovered, regular inspections and maintenance of the boiler would have been more difficult and time-consuming, possibly infringing upon school operating hours.
- Building damper mounting problems that might have led to indoor air quality problems and increased maintenance
- Improperly located temperature sensors
- Plugged duct coils on existing systems
- Missing or incorrect equipment labeling
- Equipment installed that didn't match design specifications
- Improper fresh air damper sequencing for boilers
- Fans found running backwards
- Non-functioning CO_2 sensor for HVAC control in gym
- HVAC control system "Warm-Up" mode not functional
- 100 hp hydronic circulation pumps running simultaneously
- Improper DDC-to-pneumatic-control interface, causing pneumatic system to be disabled at night
- Room motion sensors not adjusted correctly, leaving HVAC zones always in "occupied" mode

ENERGY IMPLICATIONS OF COMMISSIONING

It is difficult to accurately estimate the potential energy savings resulting from all the issues discovered and resolved through the commissioning process. However, Bainbridge Island School District had been tracking energy use at this facility for several years. They now report that, even with the additional space provided through new construction, overall energy use has dropped significantly.

More importantly, the spaces within the school are consistently being conditioned to provide a comfortable learning environment for students and staff.

ADDITIONAL BENEFITS

Other significant benefits were realized through the commissioning process. Because they were involved in assisting KWA throughout the process, school maintenance staff received training on both the new and existing HVAC systems, as well as a better understanding of the types of maintenance issues they might encounter in the future. The final commissioning report prepared by KWA is a tool they can use for reproducing equipment tests performed during commissioning; this will help troubleshoot problems in the future.

Commissioning insured proper operation of the HVAC systems and allowed the school to begin operation in an energy efficient mode, with minimal system problems. Contractors and design team members had far fewer punch list and warranty issues to contend with. The project was completed on time, allowing the school to open with all HVAC-related systems functioning correctly. The school reports that complaints from building occupants regarding either fluctuating air temperatures or indoor air quality have been minimal.

The remodeled portion of Bainbridge Island High School

PROJECT BENEFITS

- $25,300 in first-year cost benefits
- $19,500 in annual energy savings
- Identified and corrected defects in equipment, systems, and operation
- Addressed indoor air quality issues
- On-the-job training for maintenance staff and trouble-shooting tools they can use
- Project completed on time and with few punch list items or warranty issues

An additional benefit [is] a stronger relationship between the District's Capital Projects Office and Maintenance Departments as shared project goals and objectives have been realized.

Richard Best
Bainbridge Island School Distict

Pete Keithly, Commissioning Agent, and
Richard Best, Bainbridge Island SD Facilities Manager .

The program was so successful at the High School that the next year every school in the district was retro-commissioned.

J.R. Fulton
Project Manager
Bainbridge Island School District

WHAT IS COMMISSIONING?

Building commissioning is a systematic and documented process of ensuring that building systems perform according to the design intent and the owner's operational needs.

Commissioning is used in both new construction and existing buildings.

Commissioning:

- Provides a better environment for occupants
- Reduces indoor air quality problems
- Reduces occupant complaints
- Reduces contractor call-backs and warranty issues
- Reduces energy consumption and operational costs

FOR INFORMATION ON WASHINGTON'S COMMISSIONING PROGRAM

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BetterBricks
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